CUTTING LIQUID COATER

This application is a divisional of application Ser. No. 09/761,527, filed Jan. 16, 2001, now US. Pat. No. 6,460,831, which is a divisional of application Ser. No. 09/202,125, filed Feb. 24, 1999, now U.S. Pat. No. 6,199,465, which is a National Stage of PCT/JP97/04165, filed Nov. 14, 1997, which applications are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to a liquid coater that applies liquid to target objects by delivering mists (liquid minute particles) in a container. Particularly, the present invention relates to a liquid coater that applies a cutting oil to a cutting edge of a machine tool such as a machining center, a grinding machine, or a lathe.

BACKGROUND OF THE INVENTION

Conventionally, oil has been applied to target objects such as workpieces and tools in order to improve machining accuracy and to extend tool life in machining. In a method of applying liquid oil directly toward target objects, an excessive amount of oil has been applied and it has taken time to remove extra oil, thus decreasing productivity. Furthermore, since the extra oil floats up around a coater, a countermeasure for preventing a working environment from getting worse has been necessary.

When applying oil in a drop-state, machining can be conducted with a very small (minimum necessary) amount of oil, thus not only improving machining accuracy and productivity, but also leading to the improvement of a working environment and the simplification of a plant. An example of coaters that can apply oil in a drop-state is proposed in Unexamined Japanese Utility Model Application Jikkai Hei 5-92596.

However, in an oil feeder mentioned above, it has been necessary to provide a casing for an oil dropping part, a passage for a high-speed gas, a Venturi nozzle and the like in a mist generating section. In addition, since an oil tank has been constructed individually, the configuration has been complicated.

SUMMARY OF THE INVENTION

Object of the present invention is to provide a liquid coater excellent in fast-response that can generate fine mists with a simple configuration by simplifying the configuration of a mist generating section and that can convey the mists at a high speed by providing a gas feed passage. The problems mentioned above can be solved by the present invention.

In order to attain the object mentioned above, a first liquid coater of the present invention comprises: a mist feed nozzle for feeding mists into a container; a gas feed passage for feeding gas into the container; and a mist conveying passage for conveying the mists pressurized by the gas inside the container to the outside of the container.

According to the first liquid coater, droplets and large mist particles fed from the mist feed nozzle can be trapped inside the container and therefore only fine mist particles can be conveyed to the outside of the container. The fine mist particles do not adhere on the wall surface of the conveying passage easily. Therefore, it is easy to convey the fine mist particles. In addition, the conveying speed at which the fine mist particles are conveyed can be accelerated by the gas fed from the gas feed passage. Consequently, the mist conveyance is excellent in fast-response and the mists can be conveyed at a high speed.

In the first liquid coater mentioned above, it is preferable that a discharge part with a narrowed tip is connected to the end of the mist conveying passage. When such a discharge part is connected, flow velocity increases at the discharge part, thus enlarging the particle size of the fine mists and changing the fine mists into droplets. Consequently, these large mist particles and droplets can be applied to target objects and therefore it is easy to make liquid adhere to the target objects.

It is preferable that the mist feed nozzle has a double tube structure comprising a gas tube in which gas flows and a liquid tube in which liquid flows that extends inside the gas tube, and the end of the liquid tube is positioned inward compared to the end of the gas tube. According to such a liquid coater as mentioned above, mists can be generated with a simple configuration.

It is preferable that mists are generated at a space between the end of the liquid tube and the end of the gas tube by mixing a liquid discharged from the liquid tube and a gas flowing inside the gas tube.

It is preferable that a gas flow-regulating valve is connected to the gas feed passage. According to such a liquid coater as mentioned above, the mist conveying speed can be regulated.

It is further preferable that liquid for generating mists is collected in the container and flows into a liquid pump connected to the container, and the liquid discharged from the liquid pump goes through the mist feed nozzle and is fed as mists into the container. According to such a liquid coater as mentioned above, the liquid can be circulated efficiently.

It is preferable that an opening part of the end of the mist conveying passage faces to the surface of the collected liquid.

It is also preferable that the distance between the end of the mist conveying passage inside the container and the surface of the collected liquid can be regulated. According to such a liquid coater as mentioned above, the size of mist particles flowing into the mist conveying passage can be regulated.

It is preferable that the liquid pump is integrated with the container at the bottom of the container. According to such a liquid coater as mentioned above, a small-size coater can be obtained.

Furthermore, it is preferable that the end of the mist feed nozzle is arranged so that mists are injected from the mist feed nozzle toward the inner-wall side face of the container. According to such a liquid coater as mentioned above, since the injected mists circulate along the inner-wall side face, a centrifugal force is strongly applied to large mist particles and droplets injected together with the mists. Therefore, the mists and the droplets adhere to the inner-wall side face easily, thus preventing the large mist particles and the droplets from flowing into the mist conveying passage.

It is preferable that the container is formed in a cylindrical shape. According to such a liquid coater as mentioned above, it is easy to circulate mists.

It is preferable that the end of the mist conveying passage inside the container is provided almost at the center in the horizontal direction of the container. Since a mist conveying passage is arranged as mentioned above, fine mist particles gathering at the center can be conveyed.

It is further preferable that a partition in which a flow-through hole is formed is provided in the horizontal direction of the container, the container is divided into an upper part and a lower part by the partition, a liquid reservoir is